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CERSA SINCERT
Azienda con sistema qualità certificato n°393 UNI EN ISO 9001:2000

rif.: *ma-sbs-robot ver. 9.*

Step by step user manual

VISION SYSTEM

ROBOT GUIDANCE

This user manual explains the necessary steps to achieve the goal above, using the HQV / VEDO software series. Pay attention that the features here described might not exist or might be different from the ones you have bought: this is due to the modular configuration of HQV and VEDO systems.

In every picture that follows, the functions to use are **highlighted in yellow**.

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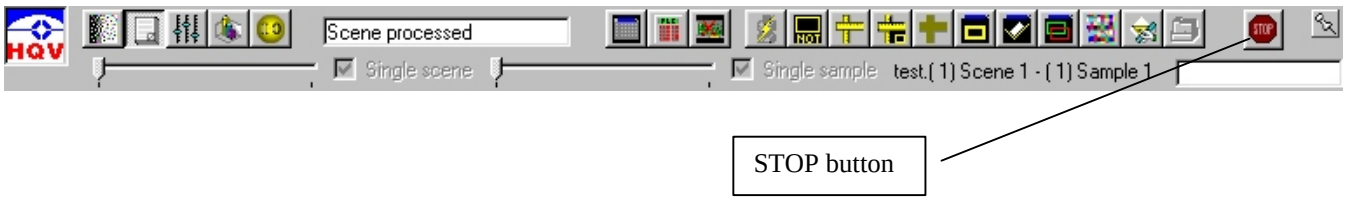
1. Create samples

1.1 Go in programming mode

If you are in the situation illustrated below, press **stop** button.



1.2 Load a project (only the first time)

In programming mode window (main menu) go in **File** menu e press **Load Project.**
In the load project window choice a project type to modify.
You choose one of the programs: called “Prog base x side”: ***x*** is the number of the piece sides.

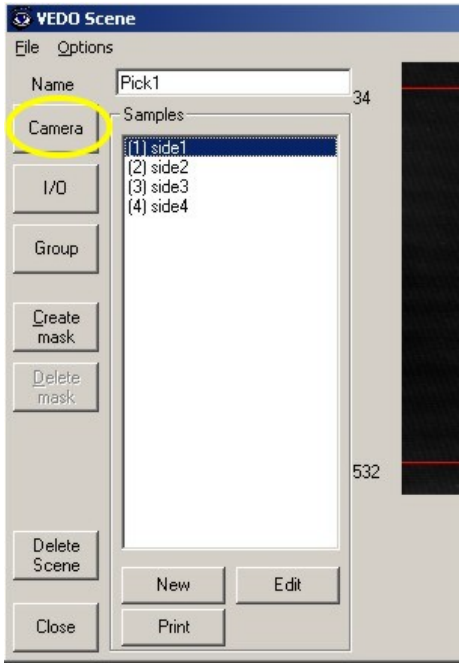
1.3 Insert programming mode password (only the first time)

In programming mode window (main menu) go in **Login** menu e press **Relog.**
In Password window insert programming password.

1.4 Take sample

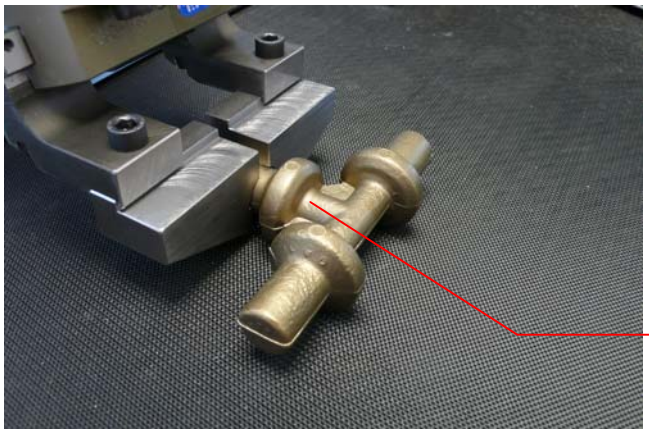
In the main menu, select “Scene” and open first scene (ex. pick1).

Click on “Camera”



1.5 Positioning sample with robot

Automatic tool calibration is a fast and simple method that helps you in the operations for scaling the camera's reference coordinates system with respect with the robot's tool one. The main idea is to place a sample piece in a valid grasp position, as it should happen in the normal machine's cycle, and then let the VS calculate and send the coordinates to the robot, with all the offsets included.



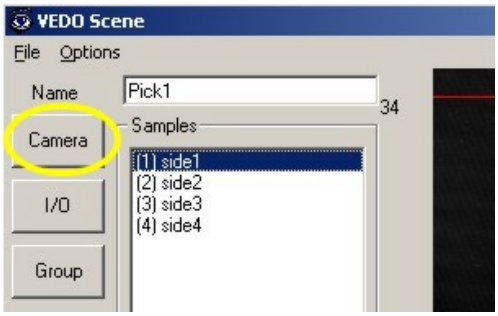
The robot put a sample piece in a valid grasp position.

Because the robot has already been calibrated, it is sufficient to place the sample piece in a valid grasp position, move the robot away from the visual field and send to the VS the piece's coordinates. For these operation use on the Robot the procedure "POSITION" for reach a correct position , left piece on belt and send coordinate to vision system (for the description see the supplied operator manual Chapter 12.2 Equipment assembling , point 6 Selection of on existing model on the vision system or create a new model)

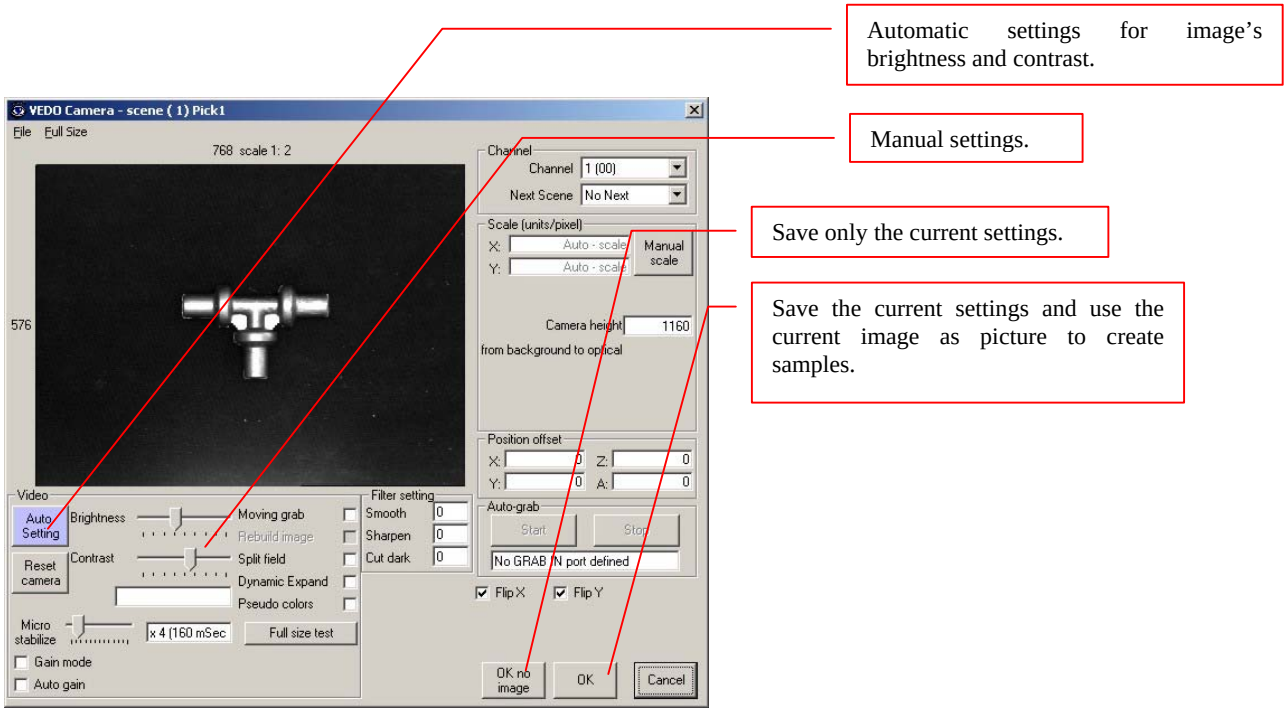
In the VS, under main menu – "Options" – "Variable", the coordinates sent by the robot will be available, so it's necessary to define a sample in the scene and bind these coordinates to it.

1.6 Take a photo

Click on "Camera" to choose the right camera for that scene and, eventually, change the brightness and contrast value as needed using the bars under the image or by clicking the button "Auto Setting".

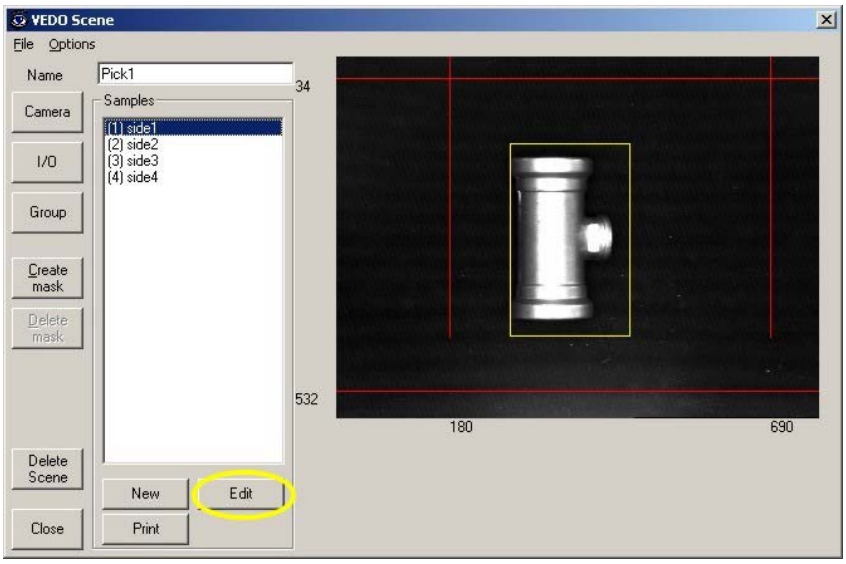


Finally, close the window by clicking "OK" in order to save both the settings and the current image, otherwise click "OK no image" to save only the settings.

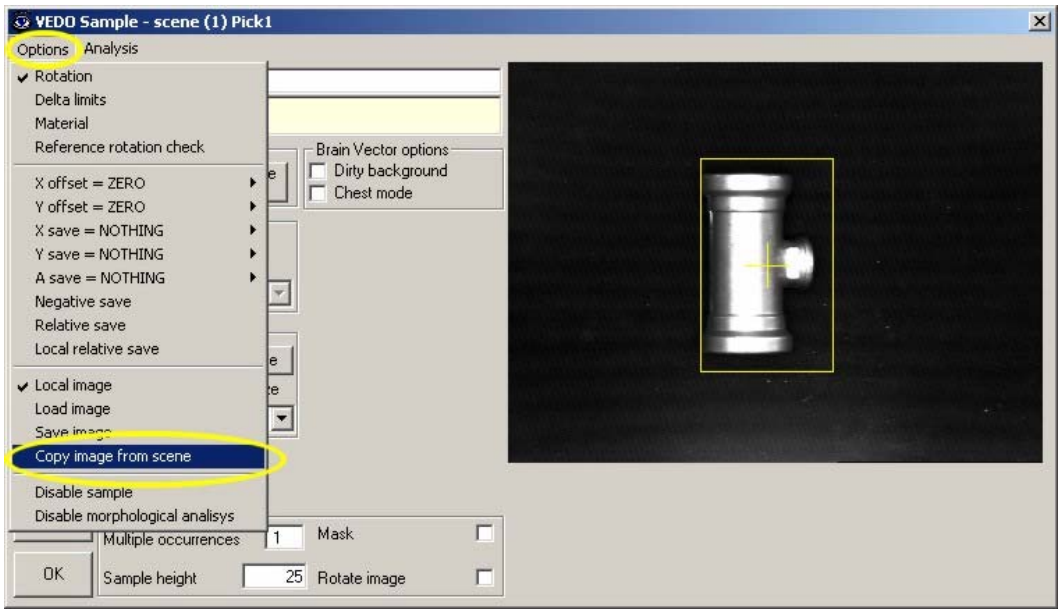


1.7 generate sample

Now, on the right of the window there is the samples panel: choice a side to edit and click on “Edit” button or double click to selected side.

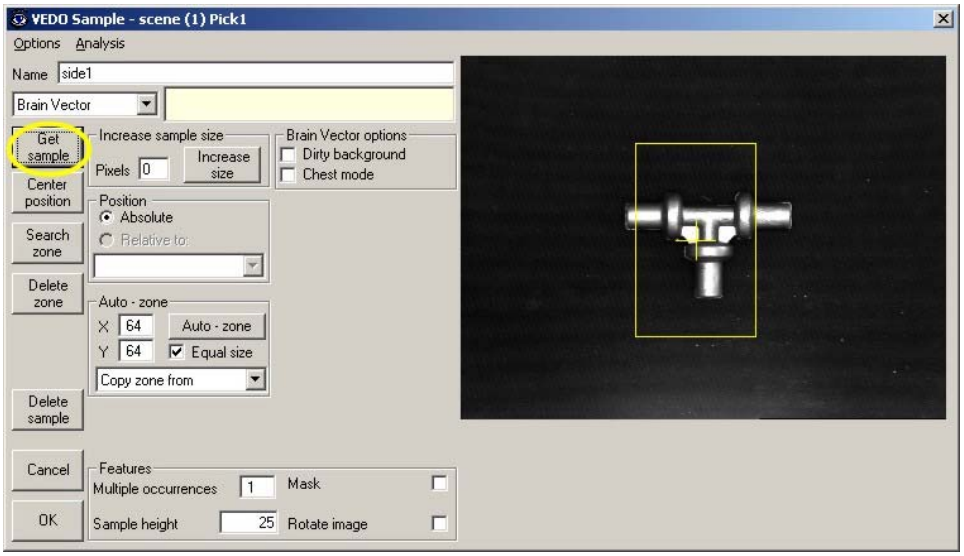


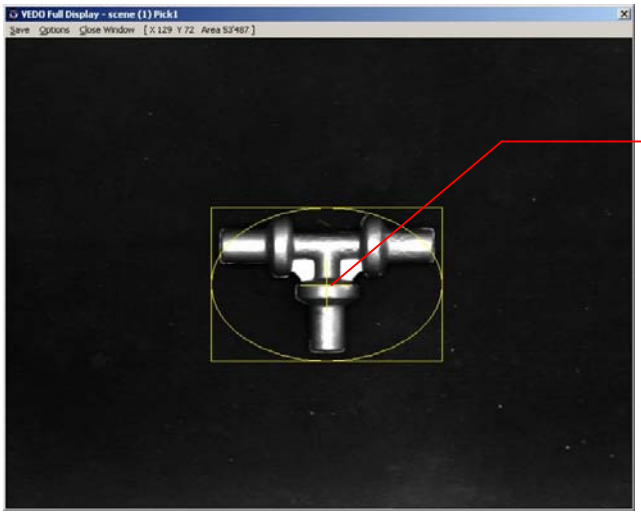
In the sample settings window, click on “Options” and select copy image from scene:



In the sample settings window, click on “Get sample” and select the desired sample using the mouse:

- Left click: define the area of the sample;
- Right click: move the area of the sample;
- Middle (wheel) click: resize the area of the sample.



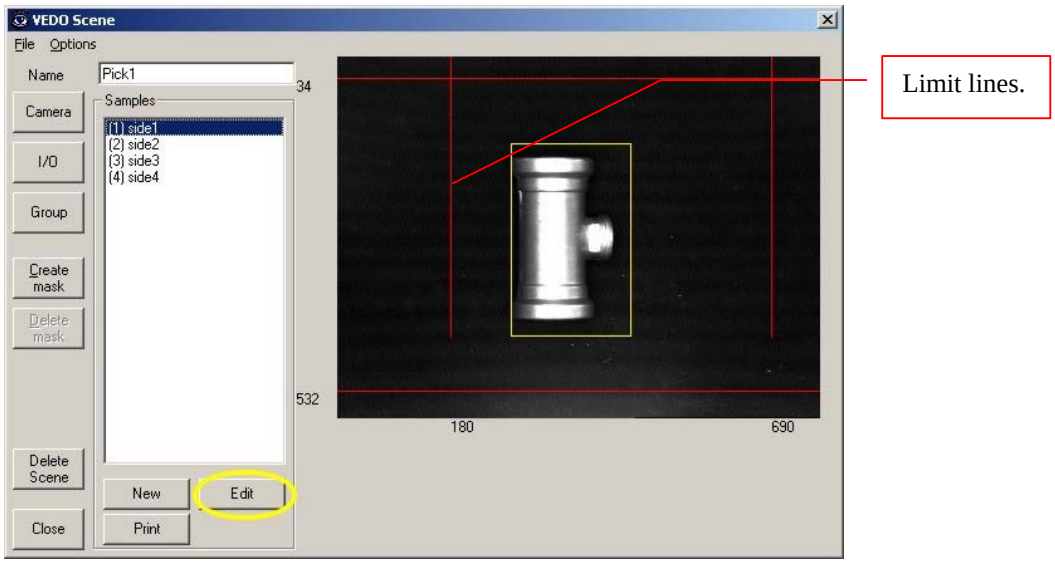


This is the window where to create samples. The yellow shape defines a sample, the cross inside it shows the position of its center.
Start from left upper corner and go to right lower corner pressing left mouse button.
You surround the piece with a small border in more.
If you want to center better the window that you have painted, you press the right key of the mouse and move it.

after press "close Window" item.

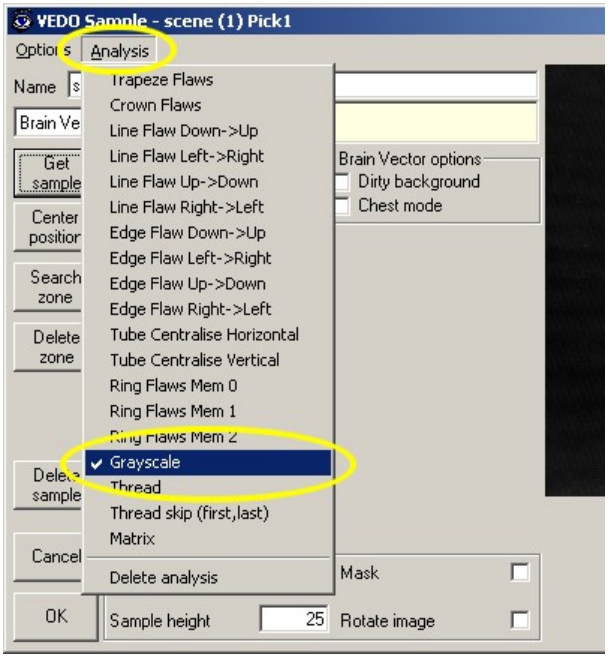
1.8 Define the work zone

You can limit the working area, for example to prevent robot collisions, moving the 4 red lines visible in the **Scene** window. Move the mouse on the red line and when you can see the cursor change simply move the line pressing the left mouse button.

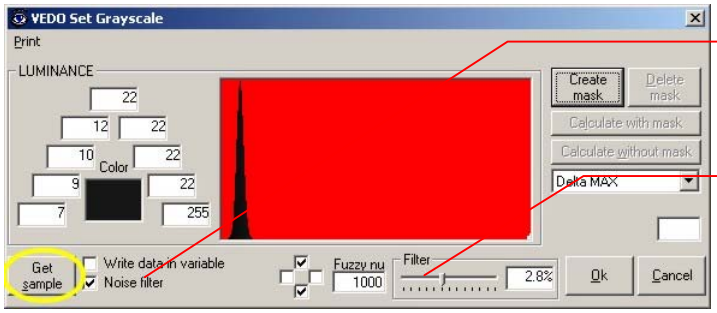


1.9 Create grab encumbrance

In the windows “Scene” click on “Analysis” to create the grab encumbrance and then choose “Grayscale”;

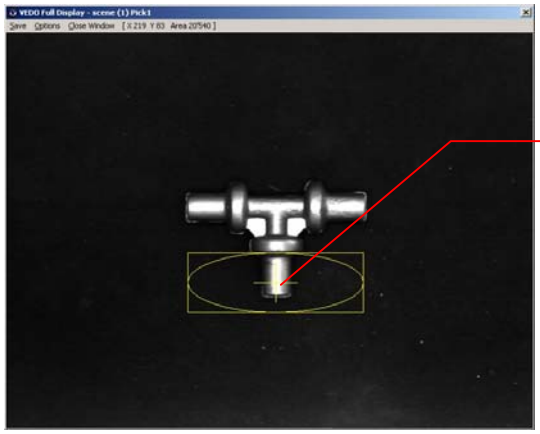


Once you choose grayscale from the menu, then the set grayscale window appears.
Now click on “Get sample” and select the desired sample area using the mouse.
Set **noise filter**, and **delta max** mode in the right select window.



Filter that reduce the effects of noise.

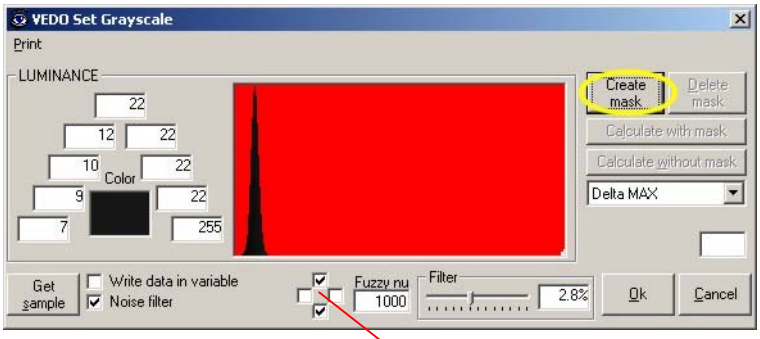
You choose the percentage of dirt on the conveyor in comparison to the area of the mask. Values from 1% to 5% are good.



This is the window where to create the grab encumbrance. The yellow shape defines where the grab take place, the cross inside it shows the position of its center.

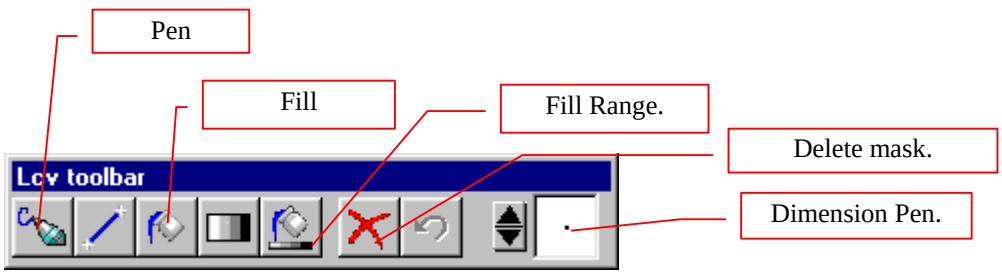
Finally, close the window in order to save both the settings and the current image.

Now click on “Create mask” and select the desired area using the mouse.

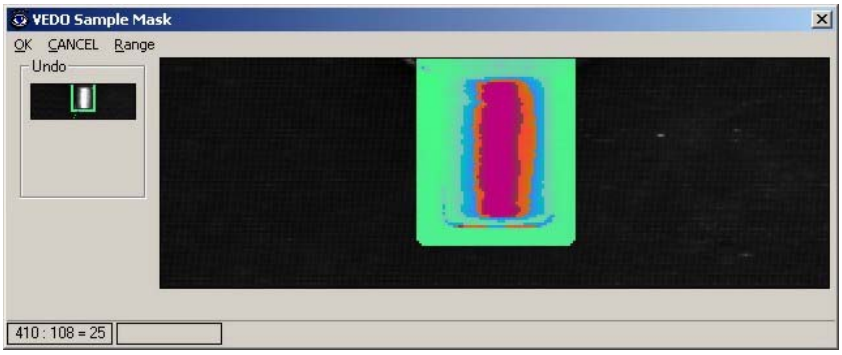


If the encumbrance area exit from the field of view in the top or in the bottom the system does not matter

use the “Lcv toolbar” to create the mask:



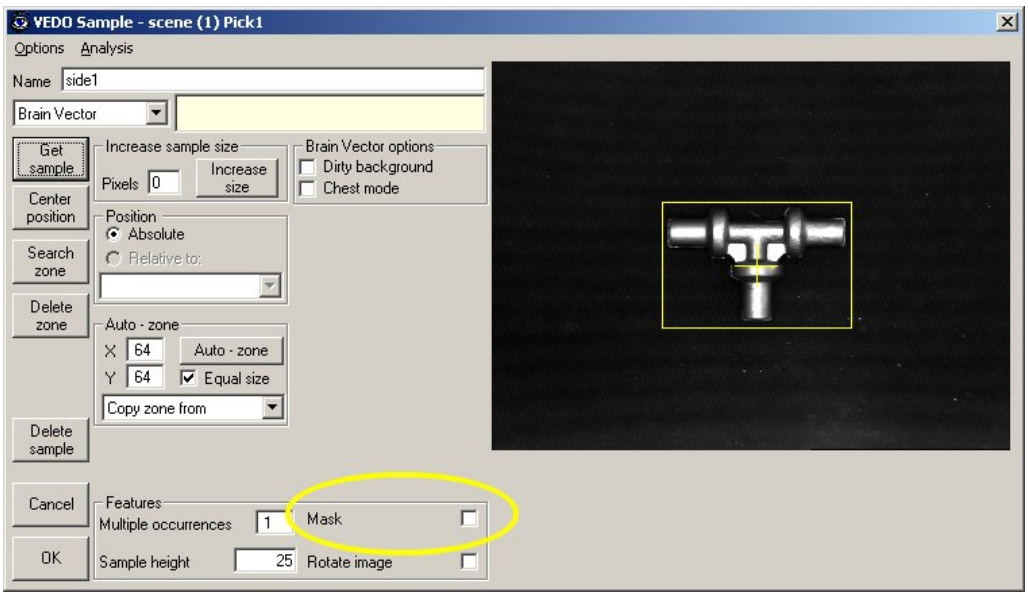
Paint the piece with a small external border and everything those parts that are not in encumbrance of the pliers. The black part is the area of encumbrance of the pliers. Finally you should obtain a mask similar to the one showed in the picture and press “OK” item.



After press OK button in “Set Grayscale” window.

1.10 Create sample mask (optional)

In the windows “Sample” enable “Mask” if you want to improve the performances of the vision.
After press **OK** button in the left bottom window side.



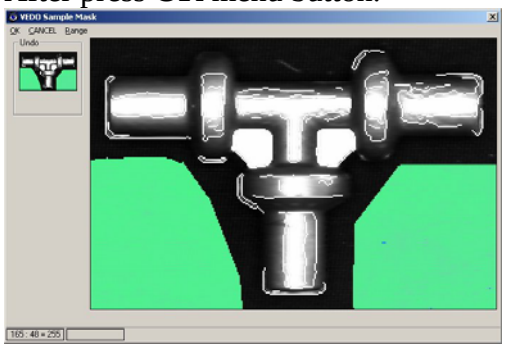
1.11 Manage sample mask (optional)

If you have chosen the mask it will appear the following window.
You paint the parts that you don't want that the vision system recognizes.
For instance:

- the conveyor
- the parts of the piece that can change as of the flash or areas that can reflect in strange way.

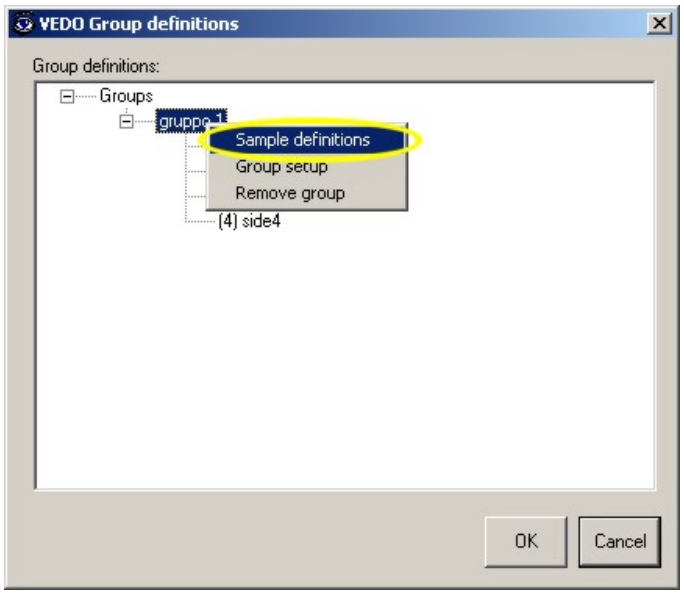
Remember to leave you some space around the piece.

After press **OK** menu button.

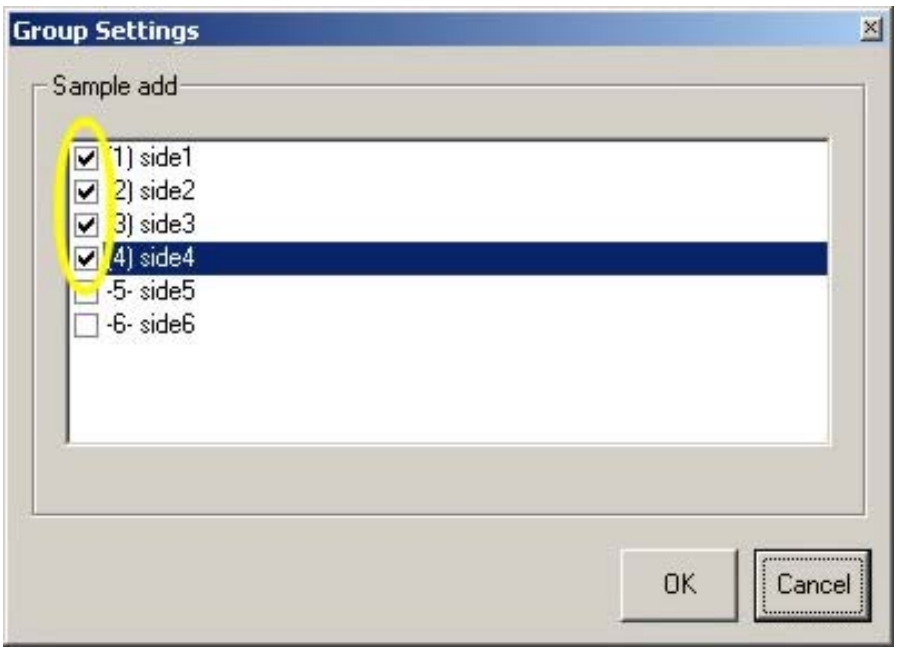


1.12 Create group (optional, normally it is already OK)

With the definition of groups of search it is possible to do so that the belonging champions to a datum group, is contemporarily sought. This allows besides the definition of searches "Front/rear" in which all the Sample are looked for but only the best of these is tried.
To create a new group is enough to select the first element of the called list "Groups" with the mouse. A menu will appear with the voice Group Add that it allows the definition of the name group and of the number of necessities to be sought for that group (Occurrences).



To select the name of the group with the right key and choose Sample definitions. A window will appear with all the Sample that it is possible to include in the group. The samples can be inserted once alone for every group.

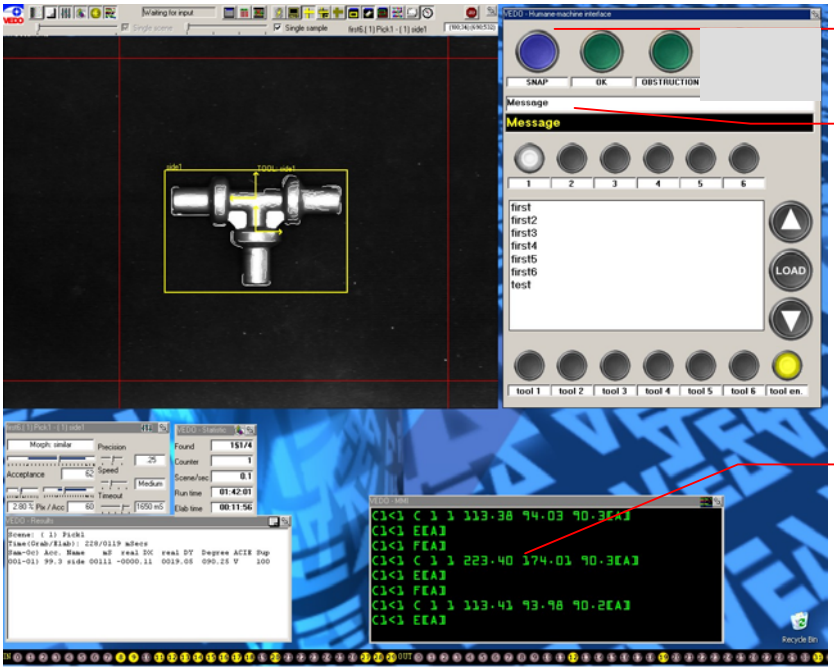


1.13 Start vision

Close scene window and in main menu press **start** or press **eye button.**

1.14 Generate automatic tool

At this point leave the piece in the same position and press the button **SNAP**, if the feneration of tool is ok a message appear in the message section: e.g. Side 1 OK



Press SNAP button to grab image.

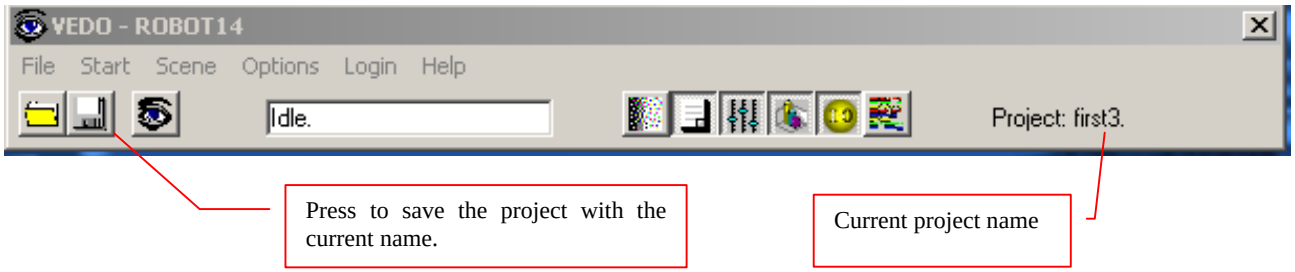
After you press SNAP button, if all is ok, a message will appear. For example: Side 1 OK.

Robot coordinate sent by the robot.

After this, the system is ready and configured; grabbing other images during elaboration will show two reference systems on the sample.
Repeat this procedure for all the side of the piece (from 1.1 to 1.10, NOT 1.2 and 1.3)

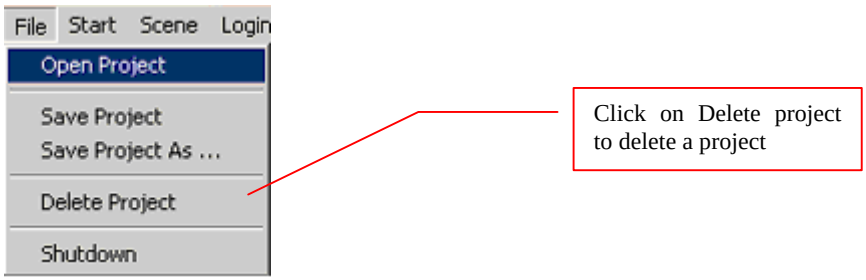
1.15 Save project (optional)

In order to save the project on the hard disk you can select “Save project as…” or “Save project” from the menu **File** in the main window; otherwise you can press the diskette button.


VEDO - ROBOT14
File Start Scene Options Login Help
Idle.
Project: first3.
Press to save the project with the current name.
Current project name

1.16 Delete project (optional)

In order to delete a project on the hard disk you can select “Delete project” from the menu **File** in the main window then select the project to delete and confirm.



1.17 Disable sample (optional)

In order to disable a sample, if you do not need more, follow this steps:

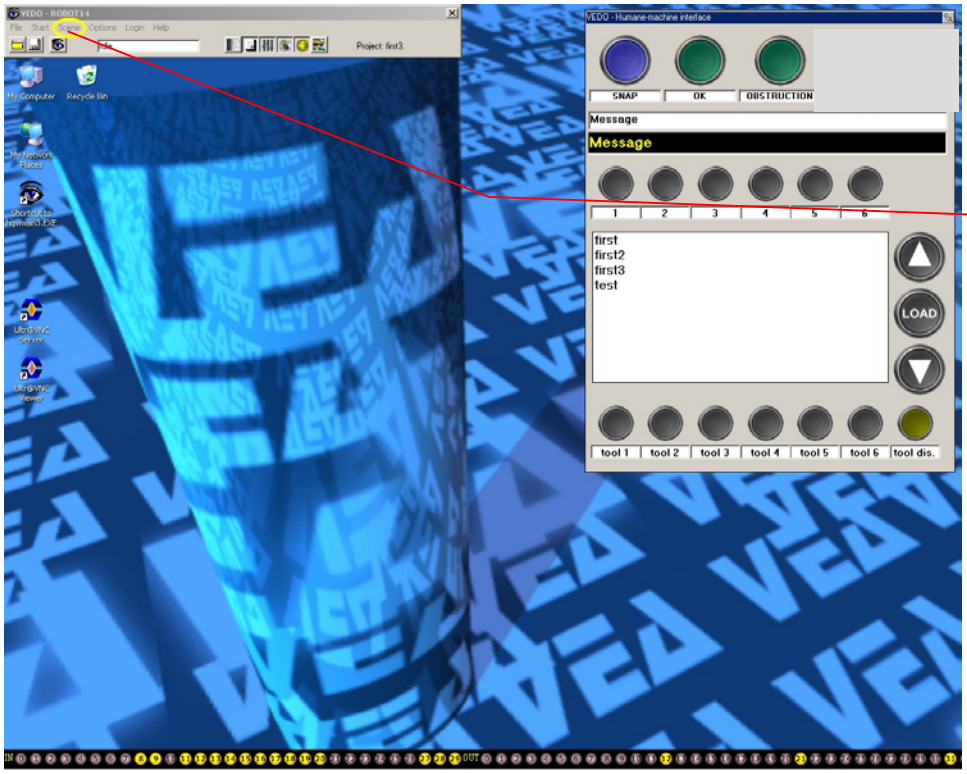
- From the window **Scene** select the sample that you want to disable, click on **Edit** button.
- Select “Disable sample” from the menu **Options** in the sample’s window.

1.18 Go in elaboration mode

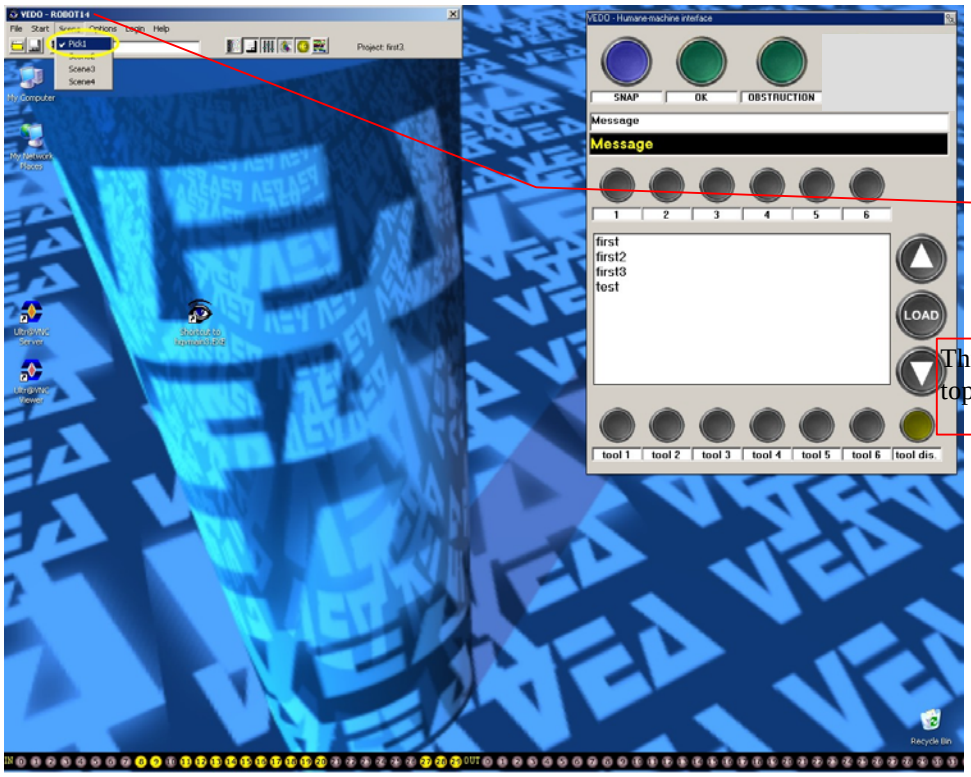
After you finish to create a project if you want to use it press the “Eye” button from the main window. Now the system is ready to work with the robot..

2. Calibration

Vision System (VS) calibration can be done both manually and automatically.
In the main menu, select “Scene” and then open the scene with the name “Pick 1” then click on the button named “Camera”.

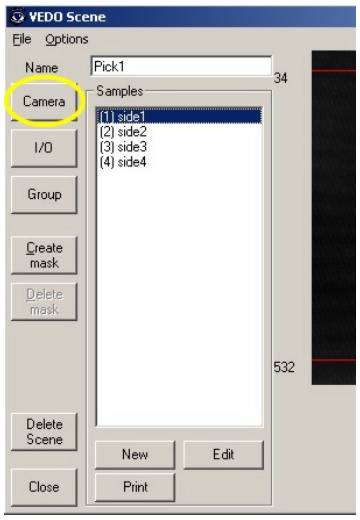


Select “Scene” from the start menu.



Open the Scene with the name “Pick 1”

This key sets the window “on top”.



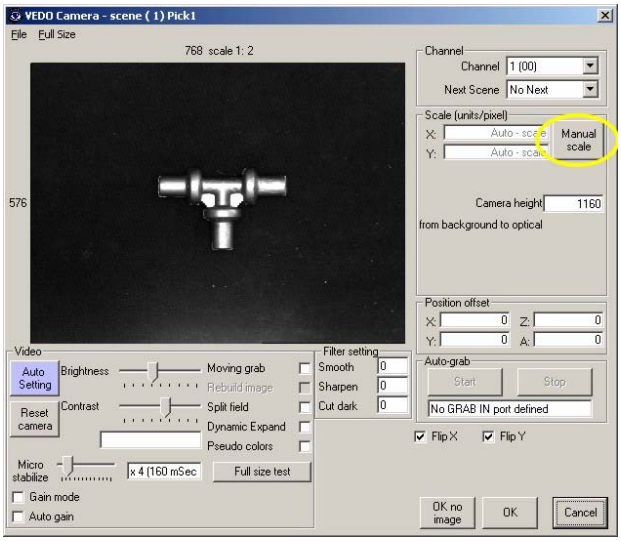
If the camera is correctly plugged, a live image will be shown, else a red screen will notify you of a lack in communication between central unit and camera. Check cables and power in case of error. Focus the image by turning left or right the focus and iris rings, until you get a reasonably clear and balanced image; fix the rings once the image is ok.

The sliders of blu zone change parameters for

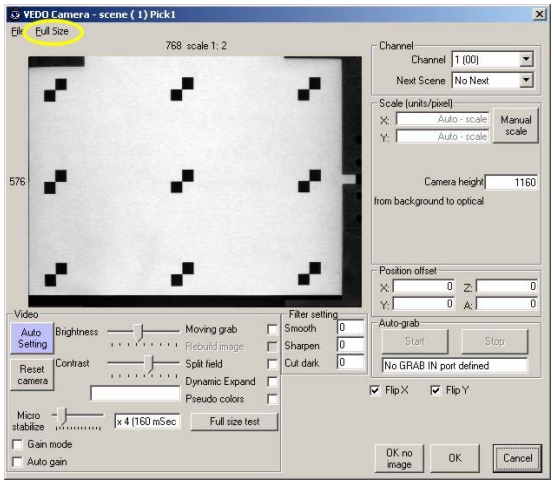
2.1 Calibration sheet

Choose a calibration sheet big enough to cover the camera’s visual field. Put the sheet in order to have the marks aligned with the image’s borders. To help you in this operation, you can select “Full display” from camera’s settings window and then click on “Options” and select “Cross”.

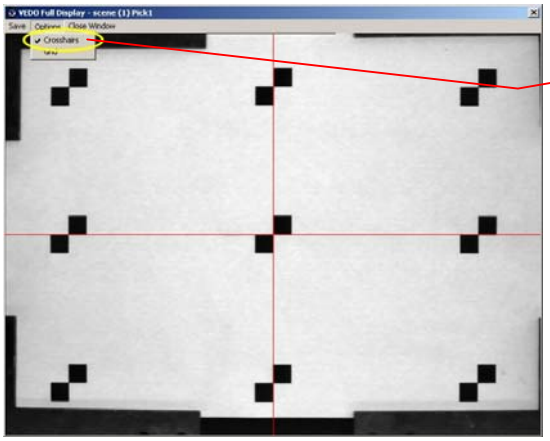
Proceed by clicking on the *Manual scale* button on the right of the camera's settings window.



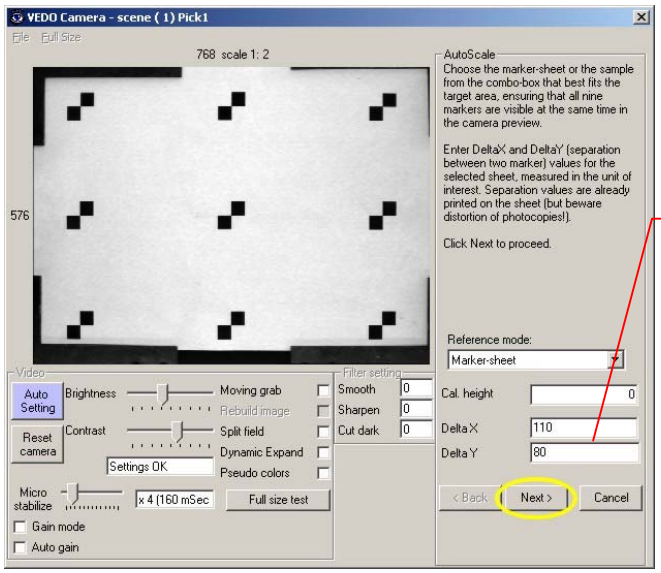
Press **Full size** to enlarge the view



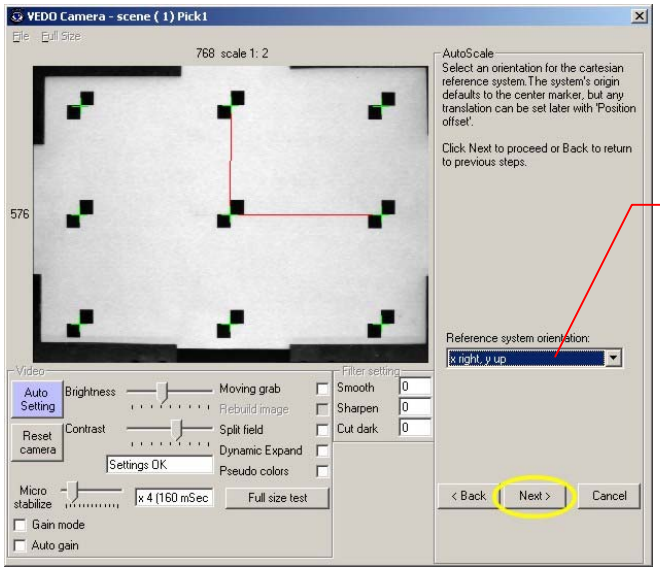
During the calibration procedure you may need to move the sheet in order to align the markers with the axis. The central marker must be positioned in the center of the cross like shown in the next picture.



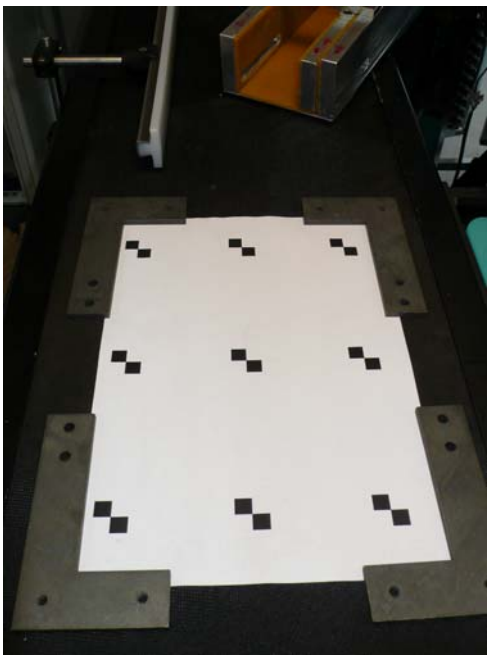
In the "Options" you can select "Cross" or "Grid" to view some useful guide lines.



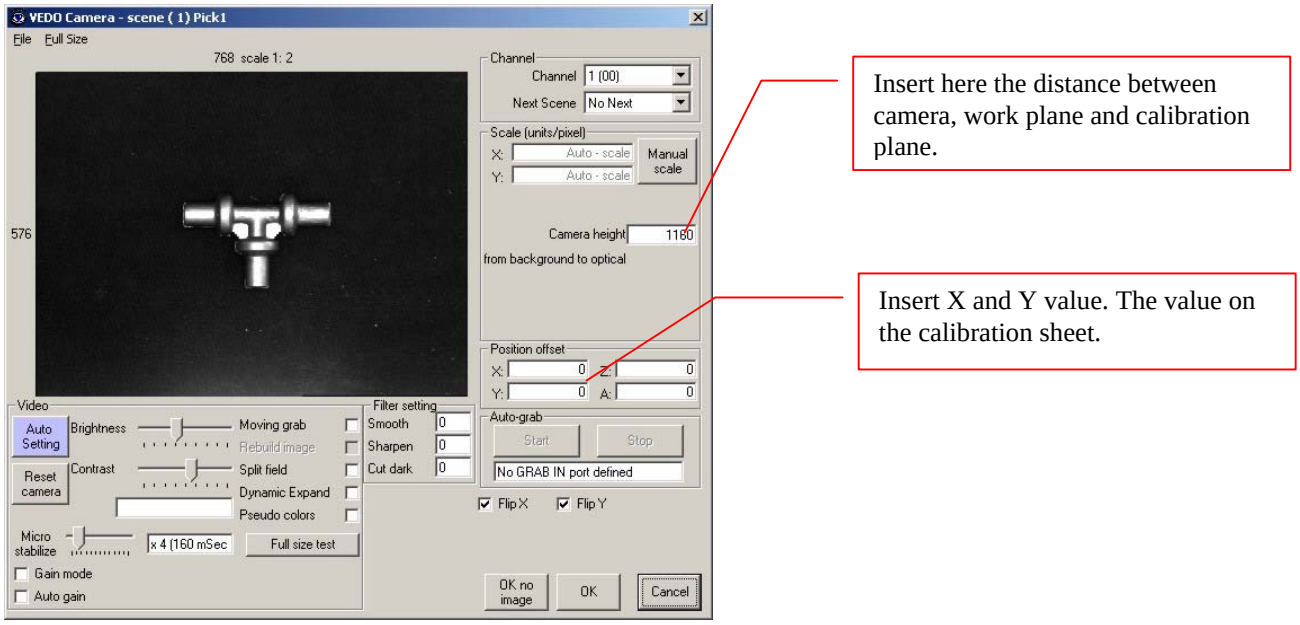
Insert here the distance write on the calibration sheet.



Choose the orientation of the robot.



At the end of the calibration procedure, insert the distance between the *optict's camera and conveyor.*



Insert in **Position offset** X and Y the same value used for delta X and delta Y during the calibration. In this case 110 and 80.

2.2 Robot calibration

After the camera has been calibrated, the next step is to calibrate the robot in order to obtain two homogeneous reference coordinates system.

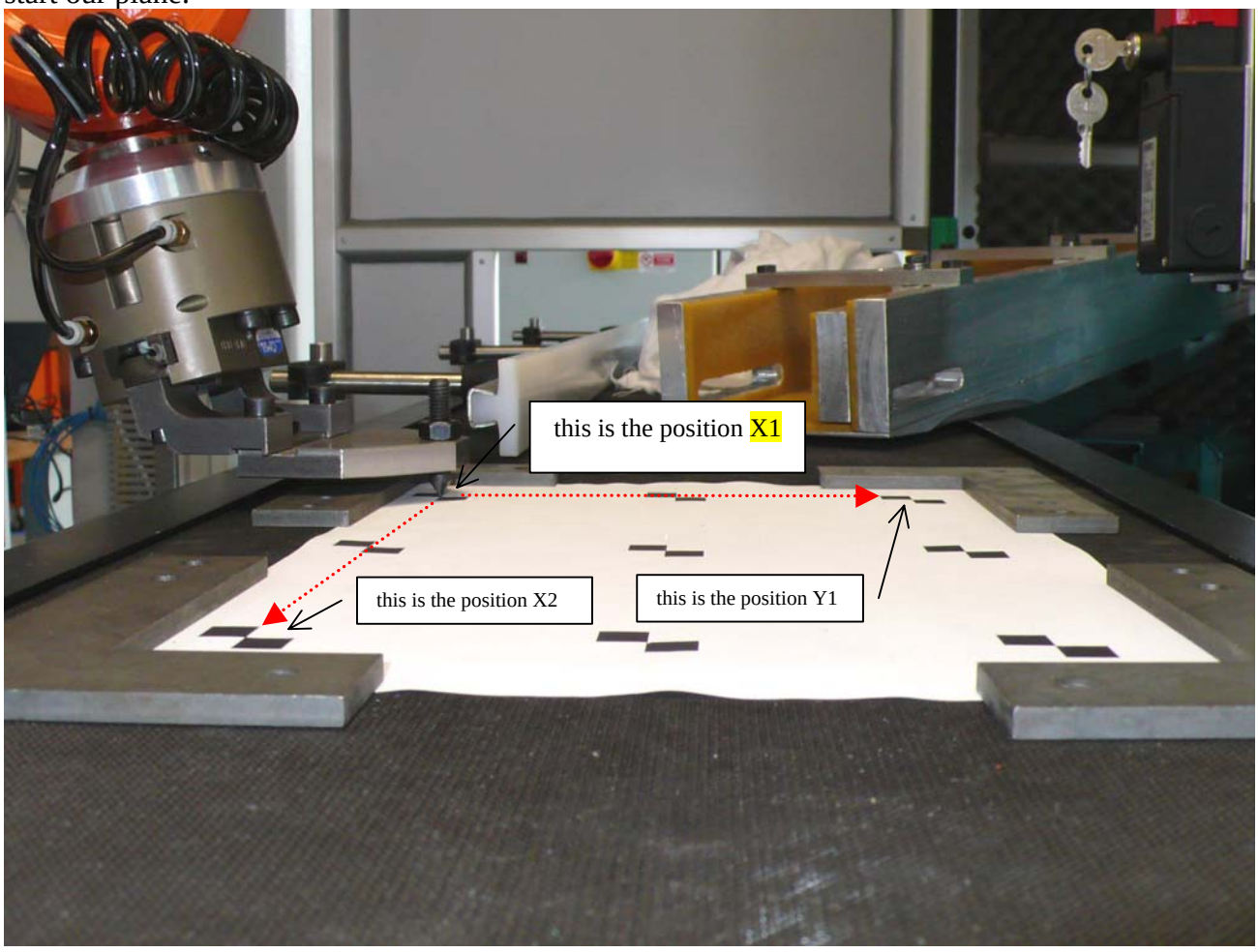
To calibrate the axis of the robot with the axis of the camera you have to define a work object on the robot. Assembly the supplied "calibrating tool" on the robot clamp and execute the following list of operations.

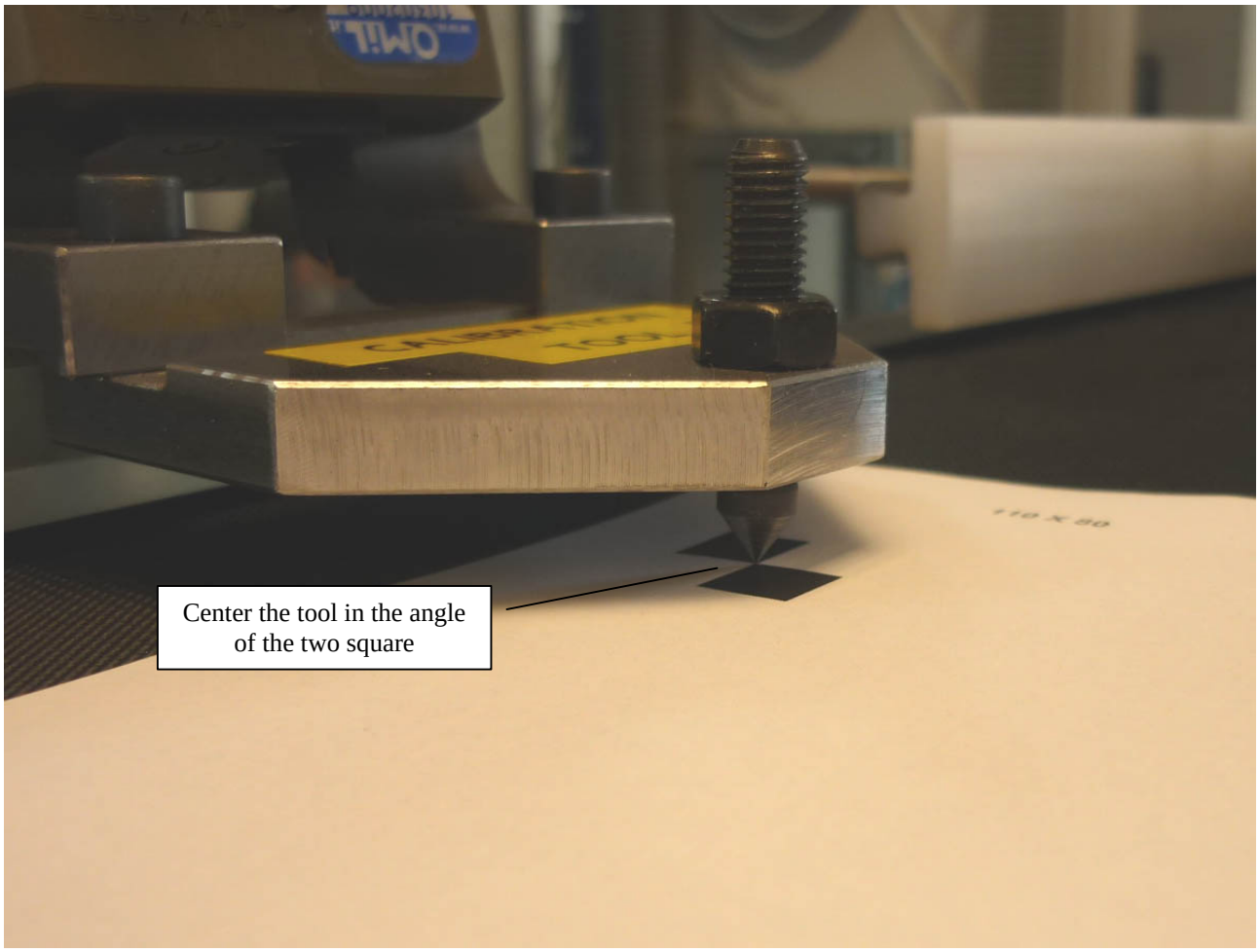
1) Push the button then button (you will see the following page).

2) Select for the Tool the "tPinza0".
Touch for select the Work Object (you will see the following page)

3) Select the work object **WoVision** (it became blue) then push the lower button Edit and choose the menu item Define… (you will see the following page)

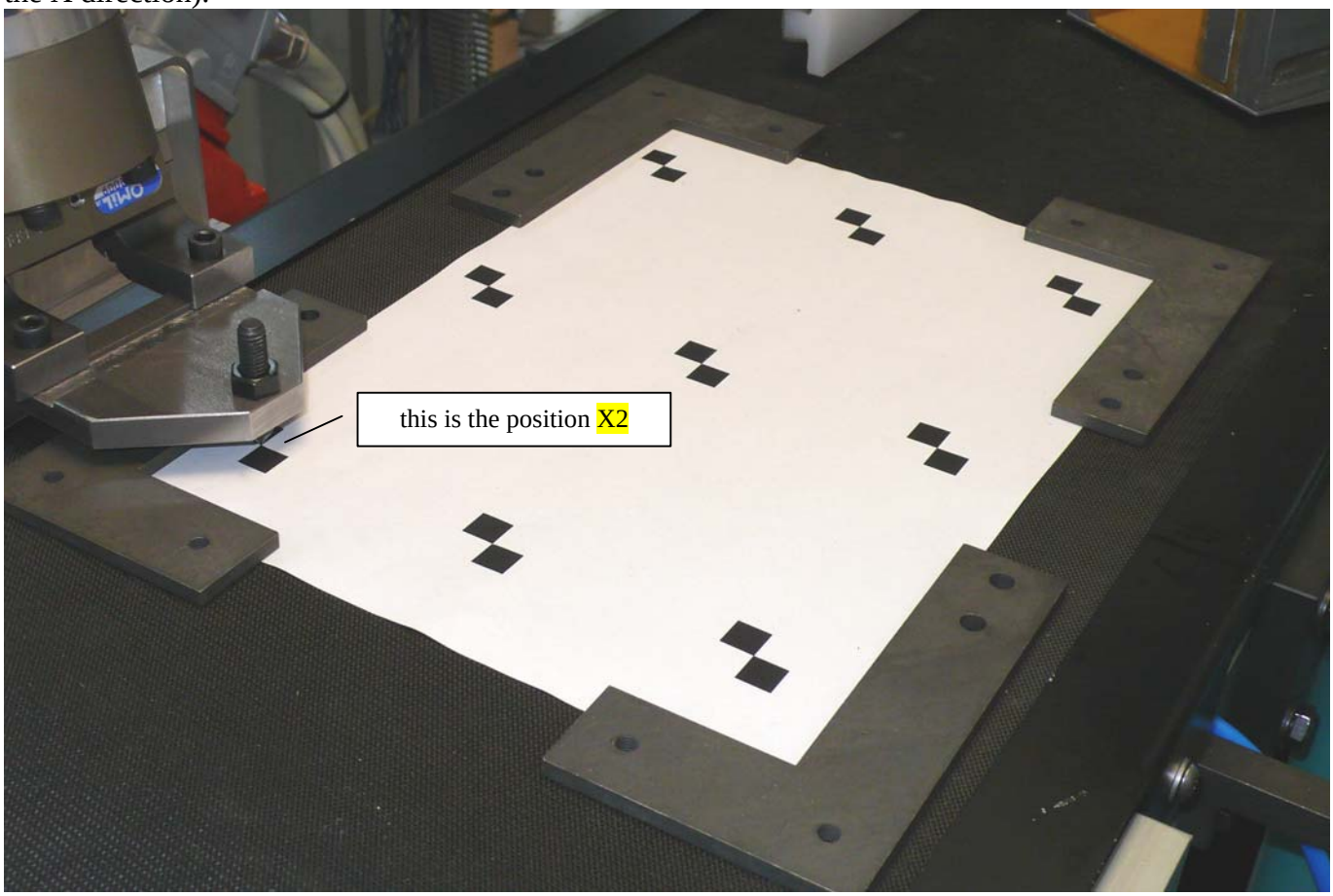
4)At the voice User method select 3 points.
Now by using the joystick of the manual movement move the robot on the position X1 where will start our plane.





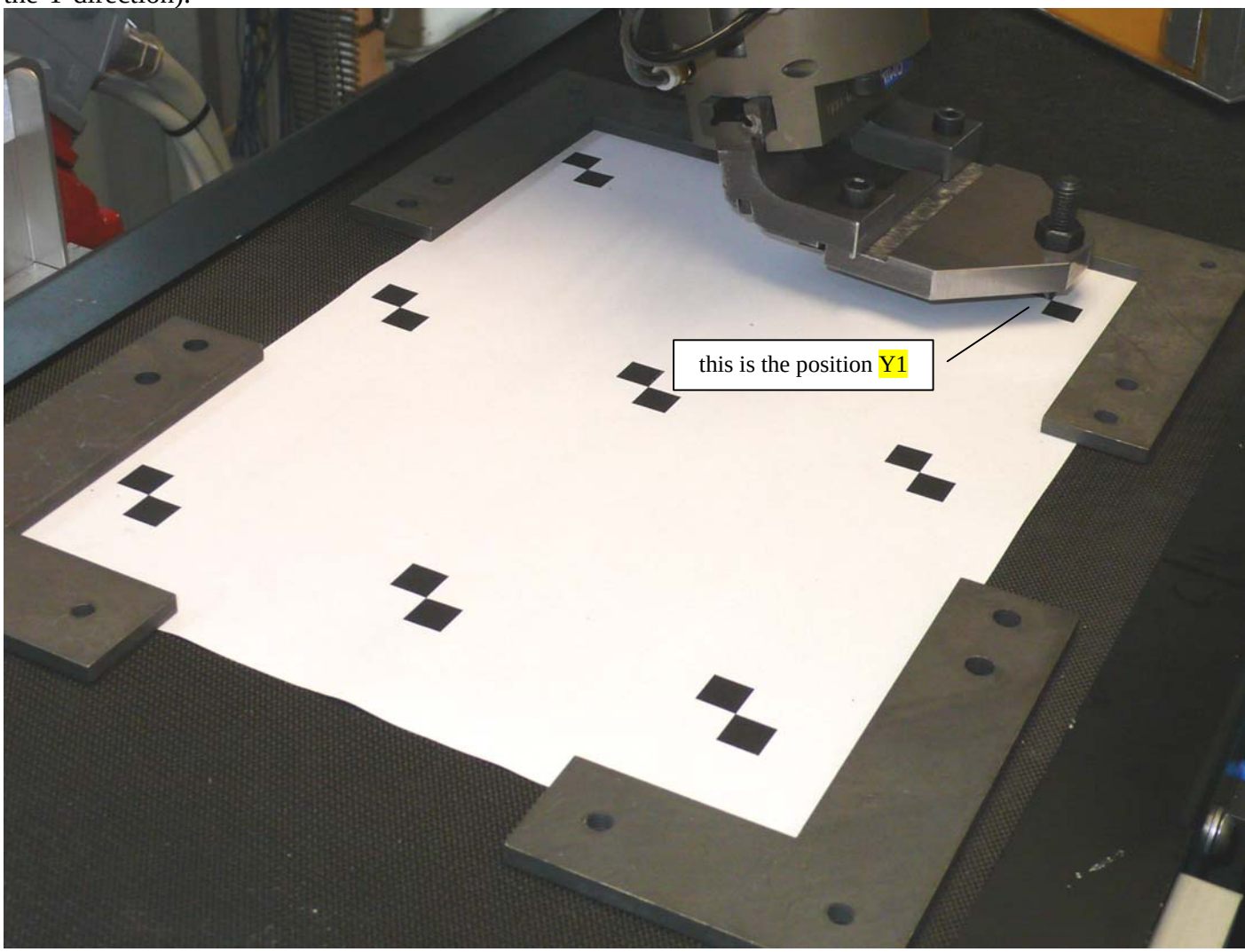
When the robot is in the correct position select the voice "User point X1" (it became blue) and push the lower button Modify Position

5) Now by using the joystick of the manual movement move the robot on the position X2 (point in the X direction).



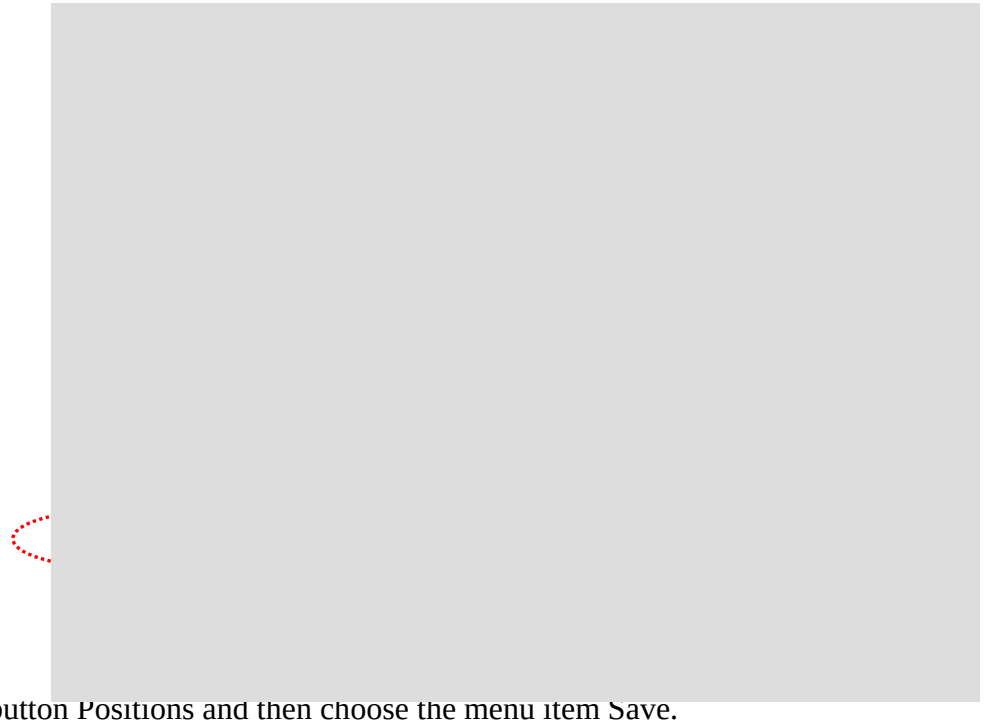
When the robot is in the correct position select the voice "User point X2" (it became blue) and push the lower button Modify Position

6) Now by using the joystick of the manual movement move the robot on the position Y1 (point in the Y direction).



When the robot is in the correct position select the voice "User point Y1" (it became blue) and push the lower button Modify Position

7) There is the possibility to save in the program these 3 points. (This point it is not obligatory to do, you can also continue to the following point).



Push the button Positions and then choose the menu item Save.
Then you have to insert in which module to save the point (left default value) and push button OK.
The points are saved and you have to confirm again with button OK.
Then you arrive again to the main page.

8) Push finally button OK for calculate the new work object.
The data of the new work object are showed , you have to confirm again with button OK.

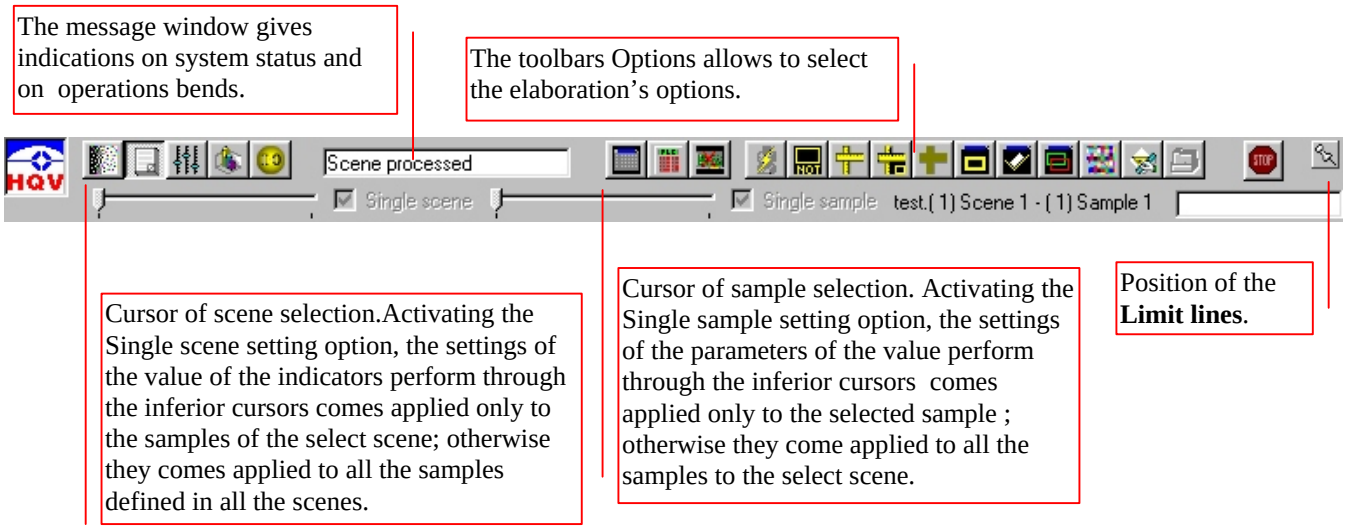
Once the robot has been calibrated, you can test the calibration by moving the robot on the other marks simply by giving the robot a couple of coordinates where to move.

2.3 Save and load a calibration settings file

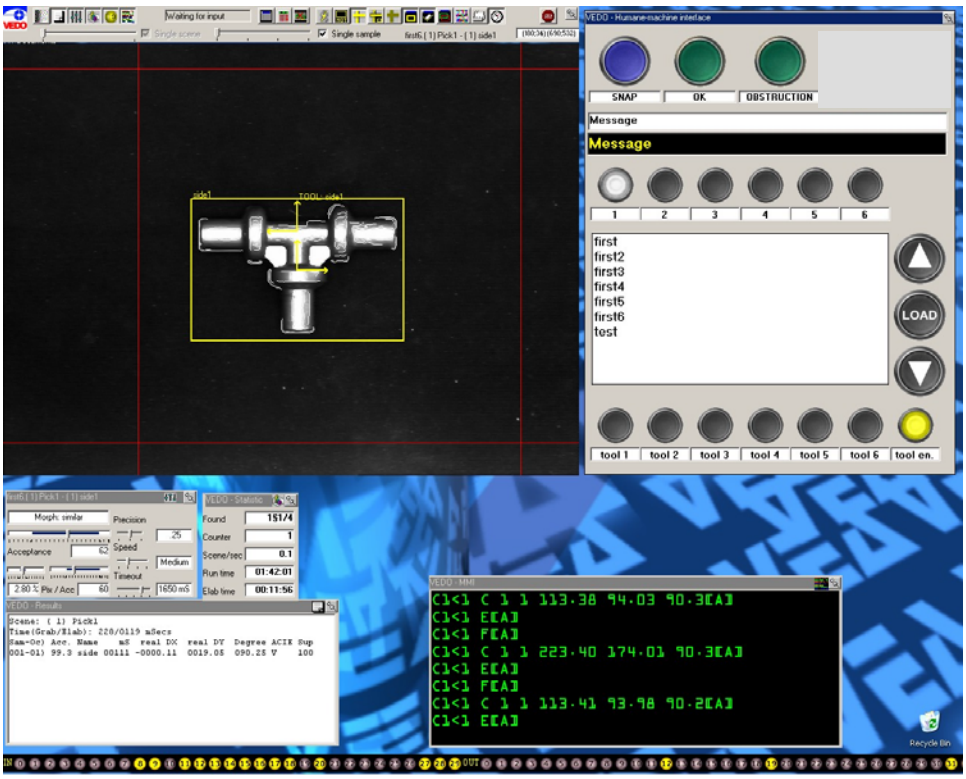
In the camera settings window, choose “File” from the main menu: here it’s possible to load or save an auto-scale file “*.map”. This function is very helpful for robot drive systems when there are different scales to manage in different projects. Files are named “defever00.map” for the default scene. These files substitute the scaling in a project: if at a given time you need to change the calibration of e.g. “scene 1”, you need to calibrate once and save it on a file named “defever00.map”. From that moment ahead all the first scenes of all the projects in the system will assume that calibration scale.

3. VS Interface

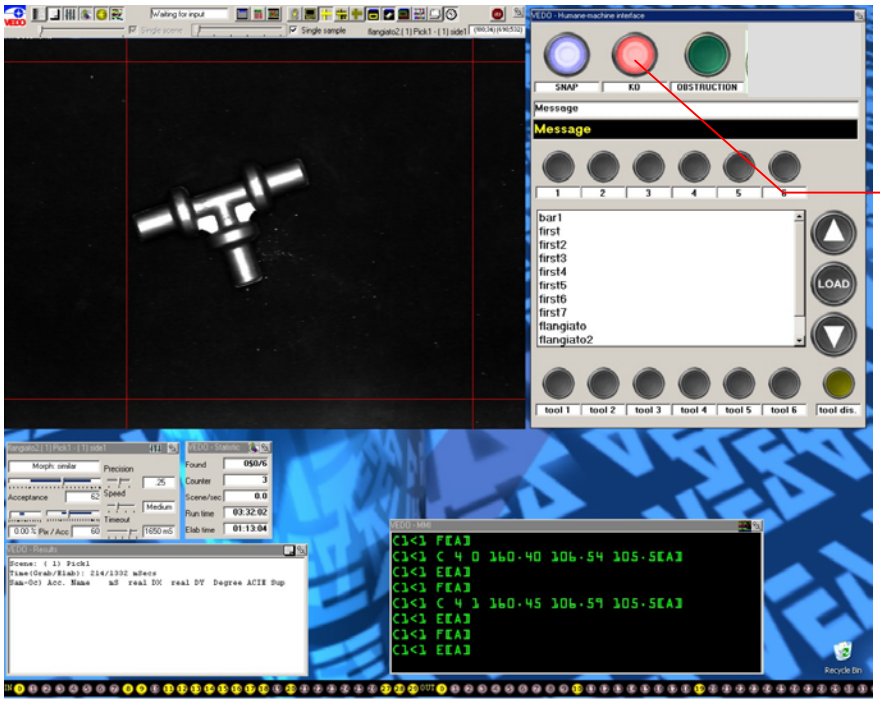
After we have defined a scene at least (and at least a sample into the scene) we leave the window *Scene* pressing the *Close* key. Returned to the principal window, we notice that now the item Start from the menu and the button with the eye has enabled: is sufficient to press one of the two for begin the control in line. During the elaboration the main window is the following:


The message window gives indications on system status and on operations bends.
The toolbars Options allows to select the elaboration's options.
Scene processed
Single scene
Single sample
test.(1) Scene 1 - (1) Sample 1
Cursor of scene selection.Activating the Single scene setting option, the settings of the value of the indicators perform through the inferior cursors comes applied only to the samples of the select scene; otherwise they comes applied to all the samples defined in all the scenes.
Cursor of sample selection. Activating the Single sample setting option, the settings of the parameters of the value perform through the inferior cursors comes applied only to the selected sample ; otherwise they come applied to all the samples to the select scene.
Position of the **Limit lines**.

This window offer the possibility of set some parameters and to select some elaboration's options. The following image represents a typical situation of elaboration:



In this case the VS give back an error because the piece was not identify.

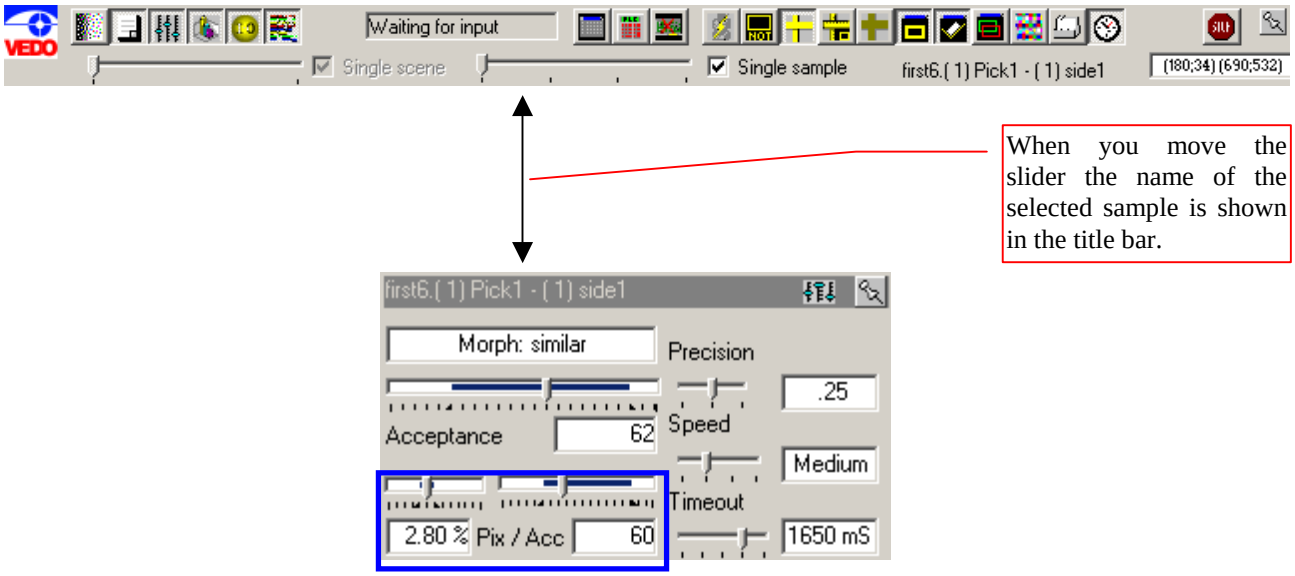


Red light on because there is an error.

3.1 Settings interface

From **Settings** window is possible to set, individually and **in real time**, some **search's parameters**. Normally the default values are good for the most cases.

Warning: Ensure to select the desired sample before change any parameters. From the main window select the sample and only after change the slider on the **Setting** window. In order to select the sample move the **Single sample** slider.



When you move the slider the name of the selected sample is shown in the title bar.

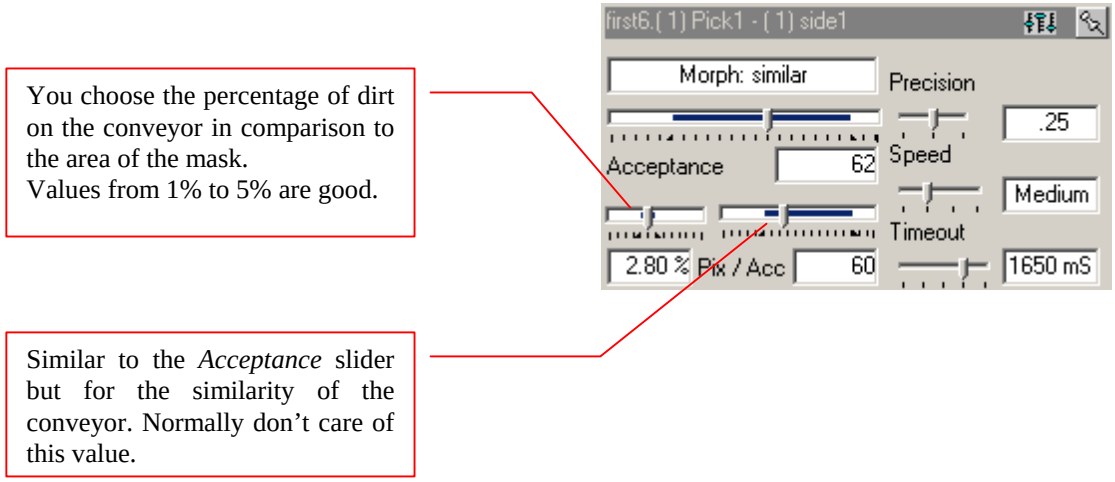
Settings window

Acceptance: all the objects that, inside of the search zone, present a degree of similarity respect the sample (express in percent) upper than the defined with the *Acceptance* cursor comes possible candidates to have identified like sample occurrences. *Acceptance* fix the threshold of similarity (respect the sample) under than an object is considered "defective" and it doesn't come "found" from the algorithm of search

Timeout: In some case the system can take a long time to return a result, you can limit this time changing this value.

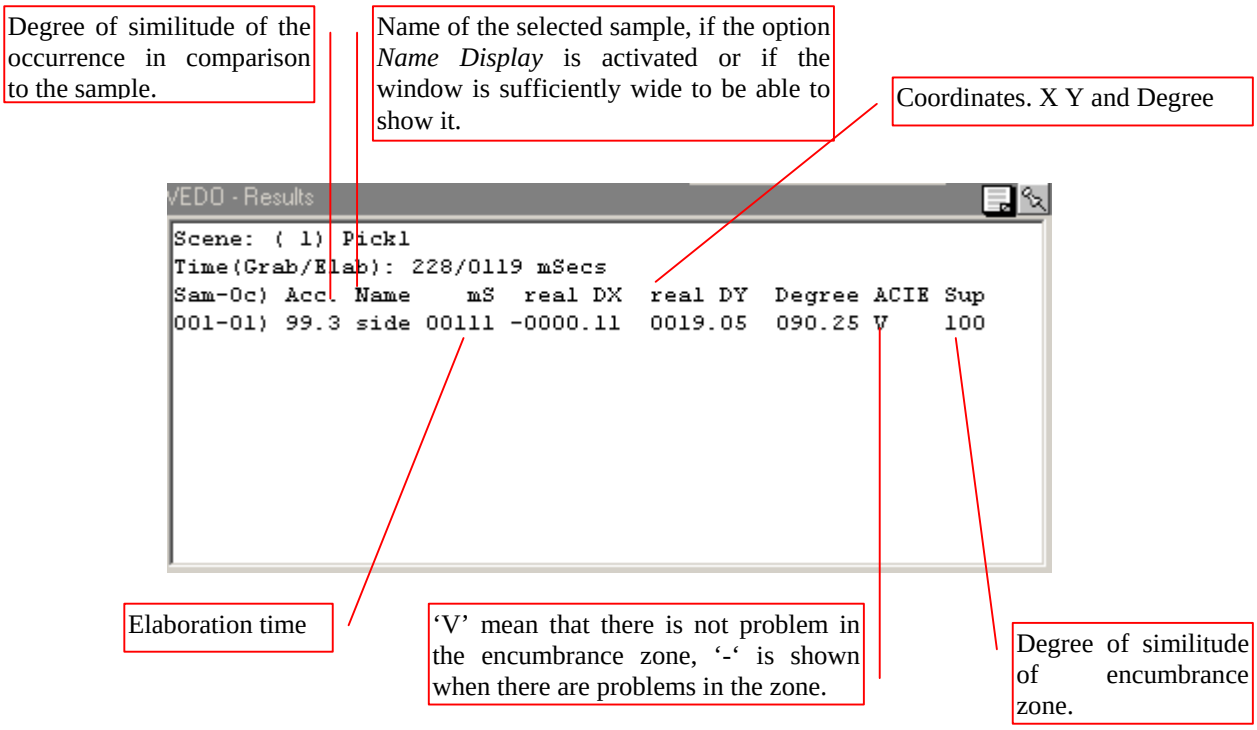
Precision: with a subsampling, that increase the resolution of the system work, the occurrences position founded comes express in 1/100 di pixel. This measure must understand feigns from certain errors, whose maximum entity define the precision of the system. Through the *Precision* cursor the operator could select (from 3 possible values: 0.5, 0.25 e 0.125 pixel) the error-ampleness of the border guaranteed from the system. The absolute maximum guarantee is 6144 X 4608 subpixels. Naturally, a precision of positioning higher involve times of longer elaboration. Medially the errors are sustained whit enough border under of the secured threshold.

Speed: allow the operator to select, from four possible settings, the recognition algorithm speed. At the higher speed the system speed up the search while at low speed is more “prudent”, preferring the reliability of the recognition (in distinctive, the tolerance to the rotations, displayed in degrees in the velocity-window decreases with the increase of the velocity). It goes however accentuated that the velocity of search is strongly biased also from all the other indicators of elaboration, and from the same characteristics of the model, from the ampleness of the search-zone, from the images-quality, from the activated options , etc.


You choose the percentage of dirt on the conveyor in comparison to the area of the mask.
Values from 1% to 5% are good.
Similar to the *Acceptance* slider but for the similarity of the conveyor. Normally don’t care of this value.
first6.(1) Pick1 - (1) side1
Morph: similar
Precision
.25
Acceptance
62
Speed
Medium
Timeout
2.80 %
Pix / Acc
60
1650 mS

3.2 Result window

The system show in real time the results of each elaboration, after every request from the robot is possible to see the results of elaboration in the **Results** window.


Degree of similitude of the occurrence in comparison to the sample.
Name of the selected sample, if the option *Name Display* is activated or if the window is sufficiently wide to be able to show it.
Coordinates. X Y and Degree
VEDO - Results
Scene: (1) Pick1
Time(Grab/Elab): 228/0119 mSecs
Sam-Oc) Acc. Name mS real DX real DY Degree ACIE Sup
001-01) 99.3 side 00111 -0000.11 0019.05 090.25 V 100
Elaboration time
'V' mean that there is not problem in the encumbrance zone, '-' is shown when there are problems in the zone.
Degree of similitude of encumbrance zone.